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THE MEDICAL PROFESSION AND MODERN CHEMISTRY.

AN ORATION

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BY

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THE MEDICAL PROFESSION, AND MODERN CHEMISTRY.

The privilege of appearing in my present position before the Medical and Chirurgical Faculty of Maryland, I count no small honor. The few years, which I have devoted to the study of Medicine, have made me feel of how little avail is the most perfect knowledge of all its principles, unless the opportunities for witnessing their application be many and frequent, and how a ripe experience bears glorious fruit to those seminal ideas, which have been implanted by our forefathers and carefully nurtured until the sturdy tree has been produced for the admiration of the world. Hence on annual occasions like the present, the young prefer to hear the words of the experienced members of the profession, to catch the droppings of a wise experience from the lips of a Gamaliel—to imbibe fresh courage for the arduous professional race they have entered upon by hearing how diligence and honest study have won the victory in the past. I feel some reluctance then, in assuming a position which presumptively implies a wide and extended experience on the part of the speaker, and only do so with the hope that the same friendship will mark your criticism that induced you to make your selection for the present occasion.

It would be interesting and pleasant to avail myself of this opportunity in order to pass over, in rapid review, what has been done by the priests of the healing art, since the goddess Hygiea communicated to them from those stores of learning, that her father Æsculapius had acquired, a knowledge of

"The blest infusions
That dwell in vegetives, in metals, stones;"

but this agreeable subject must be waived, since another intrudes its importance, and as more particularly connected with my *specialite'*, seems to claim the short hour alloted on the present occasion. Addressing a body of medical men of the varying ages found in the profession, the experience of some of whom will bear witness to the changes that science has introduced in its principles and in their application, it will not be considered out of place to call their attention to the contributions of *one* branch of science and its *real* value to medicine. This is especially important since its students are sometimes disposed to over estimate its real value, while those ignorant of its principles delight in condemning them as mere vagaries. Let us then look at the nature of the contributions of chemistry to medicine, and their real value.

If we examine the records of the past, we shall find that remedies, when first applied for particular diseases, were either so employed on account of some accidental discovery of their utility, or because a continued series of experimentation had unfolded some peculiar property. In either case the real *modus operandi* was not suspected, much less understood by the physician. His practice was purely empirical, full as much so as that of any village crone, who collects various vegetables, with superstitious respect to the peculiar phase of the moon, and stews her heterogenous mixture, in order to produce wonderful decoctions, that shall be all powerful in the treatment of disease. The larger the number of ingredients, the more complicated the process to which they were subjected, the more certain was the resulting mixture to be efficacious. The result of such experimentation was inevitably the loss of most of the volatile principles possessed by the *vegetable* material employed, and the production of insoluble and inert compounds from the *mineral* material. This was the pharmacy of the past.

The Materia Medica was indiscriminately derived from the three kingdoms of nature, and after subjection to processes that produced these results, it was expected that they would prove beneficial in pathological conditions. Here was the great and increasing evil in the practice of medicine from the earliest periods of time down to the beginning of the sixteenth century, and though it now appears here and there in some few cases, it has happily been rooted out of our practice as a prevalent custom. We have learned to see the consummate folly involved in such combinations of medicines,

and however much we may lament our real ignorance of their properties, we are not likely to imitate our predecessors, so that this very knowledge of our deficiencies will the better fit us for present and future thorough examination.

Permit me first then, to ask your attention to the condition of medication before the chemist offered aid to the physician and taught him how to extract the proximate principles of vegetables and to combine minerals so as to avoid the formation of inert or injurious compounds. This is the most conspicuous instance in which chemistry has liberally opened her laboratory to the physician, bidding him enter freely and ask boldly for what he wants, withholding nothing that lies within her power to give, frankly acknowledging where that power ceases, and in all things (when properly understood,) bringing aid and assistance to his professional labors. Not invested with mystery nor enwrapt with forbidding robes, not requiring consultation with the stars nor caring for ominous conjunctions in the heavens, not demanding heavy pecuniary sacrifices nor laying weighty injunctions on perfect freedom of action, it fully unfolds a complete armament of remedies which can be made available in proper attacks on disease.

A curious specimen of a practitioner, who followed the loose and unscientific method of the middle ages, was afforded by England, even as late as the middle of the seventeenth century, in the person of Dr. Nicholas Culpeper. From his published works, which have survived to the present day, we can obtain a very good idea of the principles, if I may be permitted to call his rules for the treatment of disease by that name, in accordance with which he proposes the selection and determination of remedies. He considers the planets as exercising a most important influence on the nature of disease and the nature of remedies, and quaintly says:* "You may oppose diseases by herbs of the planet, opposite to the planet that causes them: as diseases of *Jupiter* by herbs of *Mercury*, and the contrary; diseases of the *Luminaries* by the herbs of *Saturn*, and the contrary; diseases of *Mars* by herbs of *Venus*, and the contrary. There is a way to cure diseases sometimes by *sympathy*, and so every planet cures his own disease; as the *Sun* and *Moon* by their herbs cure the Eyes, *Saturn* the Spleen, *Jupiter* the Liver, *Mars* the Gall and diseases of Choler, and *Venus* diseases in the Instruments of Generation."

*Culpeper's Verbal V.

Culpeper was the last remnant of the Astrological doctors who had accumulated wealth and quasi honors by unintelligible jargon and mystical nonsense. His example, however, is a fair one of the profession's command of the materia medica in the previous century, when such language as I have quoted, was not uncommon in their writings. The *vis medicatrix naturæ* proved powerful in cases of disease, in spite of the nauseating or inert remedies with which the sick body was plied, and fortunately for the world, the strength of man's constitution proved to be more than sufficient for the mastery of the disease and the medicaments employed.

In the early portion of the sixteenth century the first steps to inaugurate a new era were taken by a bold and energetic intruder on old prerogatives, one whose name deserves to be held in grateful recollection by the profession at the present time, as that of the harbinger of good tidings to them and to the world. Paracelsus came before the world with much to displease and even disgust. His character was so overladen with gross faults and glaring vices that the first glance at it must excite anything but a desire to obtain a fuller and more perfect view. Yet to him we owe the abolition of the old system of prescription, and the inauguration of the new era, in which investigation was required as to the efficacy of a remedy and the cause of such efficacy. The rude and bungling efforts of chemistry, then in its infancy, were solicited in such investigations. For the first time, the science of the Elementary Composition of matter was brought to work, faithfully and well, for the profession of medicine. The results are before the world. The experience even of many members of our State Faculty has witnessed the most astounding results in the way of substitution of minute quantities of medicines for the large doses they were obliged to employ in their youth.

We are not able to trace the gradual changes which were brought about by the idea of Paracelsus,* that chemistry must have, under its own control, the preparation of medicines, and must exercise a general superintendence over "the healing art." This idea has grown to larger and fairer proportions with each succeeding year,—has developed a comely and beautiful tree whose branches are for the healing of man's infirmities. Each succeeding bold observer has increased our knowledge of remedies and their preparation, but it was left for the present century to claim as its sons, a Caventou,

*Thomson's Hist. of Chemistry, I. 168.

a Sertiirner, a Pelletier, who could extract, in their simple and uncombined form, the principles which were alone active in vegetable remedies. Need I give stronger illustrations of the value of chemical investigation to medicine, than the mere mention of Morphia with the name of its discoverer, the chemist Sertiirner, of quinia and strychnia with their discoverers Pelletier and Caventou, or of a number of other substances now in daily use, tried and approved as most convenient and efficient agents. And yet when I look over the list of the organic alkalies and find an hundred already definitely determined, all of them endowed with specific properties—the day seems not to be far distant when the whole series of remedies shall be furnished in highly concentrated forms. The past bids us confidently look forward for the most successful results. Chemistry has acquired strength and experience by her labors, and medicine reaps the benefits of those labors.

In this department then of our common profession, the real value of chemistry cannot be too highly estimated. To ignore its value here, is to deprive ourselves of the use of those things which are beginning to constitute the only reliable articles of medication, and to leap out of the progress of the present into the dull stagnation and cold mysticism of past centuries. The progress indeed of the present age has been in no instance better represented than in the history of chemistry, and the aid that its youthful ardor and vigor have brought to the veteran profession of medicine. There is something grand and glorious in this assistance which one science lends to another, something which shows how the amenities of science consist ever in aiding each other to furnish the speediest and most efficient aid to man in his extremest need.

In Physiology and Pathology also, chemistry has not been unmindful of her duty to the healing art. From the time, when Van Helmont, at the head of the party of Iatro-chemists, first advanced the theory of urinary calculi, down to the present, many of the mysterious phenomena of vital actions have been gradually made more and more intelligible by chemical assistance. Then we were taught, for the first time, that calculi were not the same as common stones but were formed from solid substances, which having been in solution in the urine, were precipitated from that liquid on something that acted as a nucleus. The composition of these calculi was not at all understood by Van Helmont. His explanation

points to their necessary composition of the carbonate of ammonia, since he considered them as all produced in the same way that alcohol causes a deposit in "*the spirit of urine*," which liquid seems to have been composed of nothing but "a strong solution of the carbonate of ammonia." Since then, what has not been done in this department alone? Urinary diseases have formed the subjects for a specialité of study. The nature of urinary deposits has been from time to time more and more studied; the perfection of the microscope enables us to examine these in their smallest and most perfect forms. The shadow of doubt that might linger, when isomorphous bodies are in the field of this instrument, has been dispelled by the aid of micro-chemistry. The old name of urinoscopist applied as an opprobrium in the profession, and worn with unblushing effrontery *out* of it by the daring and presuming quack, has lost its degrading signification and assumed a high and honorable meaning. The science which, not disdaining small things but delighting in the investigation of their ultimate significance, has invested this name with a credit and an honour, fully equal to that designating the student and cultivator of any other medical specialité. The glory of paving the way for this end was due to the Dutch chemist, whose merit, according to his biographer, consisted "in overturning a vast number of errors, both theoretical and practical, and in laying down many principles, which for want of erudition, have been frequently assigned to modern authors."

The peculiar chemical actions, that take place in the process of digestion have also aided us in understanding how vitality acts through certain laws which have been made intelligible to man, but which are held under certain restraint by others beyond mortal ken. The case of Alexis St. Martin, afforded us opportunities to know what were the results of digestion with different articles of food, and the time required to produce these results. The careful examinations of Prout, in his masterly production, gave us a division of these articles of food into four classes or varieties, composed of substances which were as unlike in their chemical composition as in the processes they underwent in the stomach, and the uses for which they were intended. Chemistry taught us how the saccharine and oleaginous portions of food were altogether different in their uses from the albuminous and gelatinous, that the presence of nitrogen in the latter showed they were for higher and, so to

speak, more important purposes than the former. The necessity, however, of the two classes of nitrogenous and non-nitrogenous articles in our food became more clearly recognized as the matter was studied. The former are the producers of the plastic material which the vital force required in order to build up living tissue and the latter, although contributing to the accumulation of adipose tissue and the upbuilding of nerve structure, still have, as their great end and use, the formation of that mysterious equilibrium of animal temperature which resists the depressing and deadening effects of polar winters, and the exhausting and enervating influences of the tropical sun. One is required to keep the animal system in perfect repair; no springy elasticity of a muscle must be deadened;—there must be no injury to the columns of the structure by the abstraction of the material which binds the support of the limbs together in the form of strong and tough bones;—no loss to the delicate structure of the sensitive nerve tissue which gives its still more delicate and intelligent centre, the brain, the command of the movements of the whole body like that possessed by a commanding officer over a body of well disciplined and drilled troops;—no alteration of that life current, the circulation of the blood, in its continuous round of duty as the carrier of fresh plastic material to all portions of the economy, and the remover of worn-out and hence, useless atoms, that have already performed their task of duty and are now to be sent forth into the world to form new compounds which shall, by a slow and gradual, but sure metamorphosis, be eventually introduced into other living bodies to resume similar tasks, and repeat similar offices;—no cessation of the mysterious formation of secretions to lubricate and keep in perfect working order, organs whose delicate structure requires them to move with the smallest possible amount of friction;—no pause in the work of excretory organs, as they remove by drains and sewers of the most perfect construction, the material that the circulation has gathered up as of no further utility or that which cannot be appropriated for any purpose whatever although it has been combined in our food along with the necessary and vitally important. What a series of wonderful and consummate instruments! All under the influence of vitality, but requiring regular supply of nitrogenous food in order that their normal force and utility can be preserved.

The non-nitrogenous articles of the food serve to establish, by the very oxidation or combustion they undergo, the heat which it is necessary should exist in order that all the varied portions of the vital system shall be retained in a suitable temperature for their healthy and normal action. Besides this, they also aid in the formation of those deposits which fill up the interstices existing between muscles, there acting for the physiological purpose of protecting the body from external injuries and as a nonconducting covering to prevent a too free communication with the external temperature, concealing also angularities that would offend the eye and serving for the æsthetic purpose of giving beauty and grace to the animal form.

By our knowledge of the requirements of the system and the character of the various articles of food, we are prepared to select those which will most certainly meet its wants. Our reasoning is not based upon mere assumptions, but upon the firm stratum of facts. Now, the value of a knowledge of the chemical constitution of food is so apparent in a multitude of cases which present themselves at first thought to the profession, that I need not dwell longer on this subject. We are all employing the results of chemical investigations with reference to food, though we seem to be singularly unmindful of the very science which has given them birth, singularly forgetful that this is a contribution to our knowledge belonging almost entirely to the present century, and a result obtained through the recondite and abstract workings of the laboratory. The sum of our knowledge on the subject is by no means complete. Each year adds something. The experimenter has taxed his intellect with the question, "*how* can the various articles of food be preserved so as to avoid the eremacausis or putrefaction to which they are liable, if left unprepared and unprotected from the ordinary agencies of heat and moisture." The possibility of long voyages by sea, or journeys by land depends upon the nature of this answer. It has been given in such intelligible language that the capitalist has undertaken its application, much to the benefit and even preservation of human life. The vegetable articles of food, so necessary to the perfect preservation of life, and whose absence prove so prolific in scurvy and the other diseases that an improper character of food always engenders, are now freely furnished to the sailor, on the rough waves of the ocean, not as a mere luxury, but

as an absolute necessity for his health and life. And experiment has not ceased here, it has seized the nutritive matter in meat, combined it with farinaceous material, and, in a dry and compact form, has furnished in most concentrated condition, the various kinds of food which the animal system demands.

These contributions to medicine have given aid to an intelligent comprehension of disease. They show the material necessary for the support of the body, and we are able thus to account for the low condition of health in those whose food does not contain the proper amount of material to sustain the vital actions in their normal condition, and also of those, whose food, without being scanty, has been subjected to such changes as have converted it into poisonous rather than nutritious substances.

But if we examine another of the great processes of the body, equal in importance with digestion, and conjointly with it constituting the keystone of organic life on which depend all the other functions of secretion and excretion, of absorption and exhalation, and to which they owe even their necessity and existence,—if we examine the process of respiration, as connected with the circulation, we shall be able to see that, here chemistry has also thrown in no small contribution to the aid of medicine. What has not been done, since the priceless value of oxygen gas to man's health and strength has been clearly understood, in the way of a general adoption of hygienic means to ensure a full and adequate supply of this agent? Is not the whole system of proper ventilation due to the first discoveries of the pioneers in pneumatic chemistry? The close and confined air of chambers had probably proved detrimental to the health of thousands, and yet the cause was left until the close of the last century, involved in darkness and obscurity. Now we know that as it is a man's birthright to enjoy the blessings of the pure air of Heaven, he is also by right of his birth necessitated to make use of this air in its purest condition without let or hindrance. And moreover, with each act of respiration, the exchange he has made for the aeriform contents of his lungs with the air around him, gives to the latter a principle which is of deadly potency, when present in large quantities, creating the necessity for the preservation of a free circulation of air, as well for bringing that which is pure as taking off that which is impure and poisonous. Who can tell how many stout, healthy men owe their lives to the discovery of these facts,

or how many of the beautiful and graceful women of our land are also indebted for the glow of health that covers their cheeks and the never-tiring elasticity and sprightliness of their spirits to the same? The patient is no longer condemned to the close and suffocating atmosphere of rooms with every window and door closed, every chink and crack carefully filled up, to piles of bed clothing and other rude tortures which our fathers in medicine deemed necessary to impose upon the sick; but the free admission of the pure air ensures the speedy removal of those gaseous emanations that are given off from the body, and produces grateful and stimulating effects upon the whole system. Has not the treatment of small pox, scarlatina and various other eruptive diseases been perfectly revolutionized in proportion as the absolute necessity of pure air was comprehended by the profession? The hot, diaphoretic teas, tightly closed and highly heated rooms and thick layers of blankets, the enervating effects of a continuous exhausting flow of perspiration, the suffocating and noxious odors—all these belong no longer to an enlightened practice of medicine. A trace may perhaps here and there linger in the practice of some veteran, whose respect and love for the past requires him to overlook all its gross ignorance of the lights which chemical and physiological science have brought out for the better reading of the needs of the living being. Yet this trace seems now to bear no more comparison to the general practice, than the superstitions, which linger on the mountain side with regard to the great influence of the stars and planets on human affairs, or the significant meaning of signs and omens do to the general spread of intelligence thoughout the world. It is like some fossil that has been exhumed by the diligent naturalist from a deep stratum—an expressive testimonial of the past, but a non resident of the present age. A new era has been established and he that would compete with his brethren in the field of practice, must accustom himself to its laws and usages—must learn the laws which have produced its principles.

The journals of the day give us interesting accounts of the labors of Bernard, Lehmann, Poggiale and Figuier with reference to the glucogenic, or sugar forming function of the liver, and our views as to the presence of sugar in the body are beginning to undergo great changes. A few years since and the appearance of sugar in any of the secretions would have been considered

as the death-knell of a patient. He would have been submitted to a strictly meat diet, deprived of those little luxuries which give relish to food, and, by a slow and torturing process, would have been hastened on to the confines of the grave. Its mere appearance was considered sufficient to justify the opinion of the medical attendant that Diabetes mellitus was established. Now, sugar is admitted BY ALL, to be at least an occasional constituent of some of the fluids, and many insist upon its being a regular and normal product of one of the viscera. In either case, we are not induced to form any unfavorable prognosis from the fact of its presence. The experimenters, whose names have been mentioned, are examining the subject with that ardor and zeal which seems to ensure a full clearing up of the whole matter, and we may reasonably expect that, the way being opened for a more rational theory on the subject of the presence and uses of sugar in the economy, a more rational method of treatment for those cases where it is in excess will speedily be adopted.

Need I call to the recollection of my fellow members the fact that only in this decade of years has Therapeutics received from the hand of Chemistry the proper mode of treating Colica Pictonum, and removing the serious effects which Lead produces on the animal system. What value attaches to the use of Iodide of Potassium, in these cases, the experience of many has most liberally shown since the first proposal of the remedy, and Melsen's name has been numbered among those who have contributed, to the enlargement of the field of successful medical practice, by their chemical knowledge.

But the instances accumulate so rapidly, that their mere enumeration would weary the patience, and would not prove the utility of Chemistry one whit better than those I have mentioned. It is of far greater importance for my present purpose to bring up these *striking* instances for consideration, and then to look at the real extent of the aid Chemistry can give to medicine, and why it claims attention, most careful and strict, from every member of our profession. From results, we can all the better go back to the causes which produce them,—even to the fountain head that ever sends forth some additional rill gushing from the immoveable rock of truth, trickling down its unadorned and rugged sides, leaping gaily along the channel it has worn out from the soil, ever increas-

ing in force and strength by collecting from tributaries that pour into it on the way, and at last forming the majestic river which moves onward in powerful current, to the great ocean. Who shall stem its onward progress, or endeavor to prevent its waters from performing their mission in bringing to arid and thirsty banks that moisture, which causes meadows to clothe themselves with the green and joyous garments of spring, and trees rejuvenated and bedecked with richest foliage, to become vocal with the songs of countless birds? Who shall say, *thus far* shalt thou go and no farther? Who shall succeed in rendering its waters foul and muddy by stirring up the bed along which it flows? And yet there are those in the world who have lived many years without being conscious of the agency of such streams in imparting life and health and vigour to exhausted nature. And there are those also in the profession who constantly employ the results of scientific experimentation, without once dreaming that it is their privilege, nay, their duty to hunt out the cause of these results, to investigate the branches of study which have proven so beneficial—so invaluable to their own progress; and not to slight such knowledge by the malicious shrug of the shoulders and the cant phrase "it is not practical."

Ingratitude has always been considered as one of the least pardonable offences that man can commit in the social and business relations of the world. Our sense of right, rebels at intentional neglect or forgetfulness of those benefactors who have given aid and assistance in the time of want and need. The moral sense of a community is outraged by any glaring instance of this sin, but does it become any the less a reflection on the character of the offender if he be found availing himself daily and hourly of the assistance of any branch of human knowledge, without rendering it that credit which is its due, or even still more without acknowledging that its existence is necessary to the full support and maintenance of his own position?

An indissoluble bond binds all branches of science together. A chain whose links can never be burst asunder, is thrown around them all. Like the bundle of rods in the fable, united, they can resist all efforts to destroy them—remain firm against any hostile attempts; divided they are liable to destruction. Hence the necessity of preserving the intimate relation which binds collateral

branches together, bringing them in close contact where they can interchangeably give and receive strength and support. Or rather permit me to compare them to living branches of the same tree, drawing sustenance through one trunk from the mother earth, connected by vascular tissue which by many an anastomosis and inosculation makes an injury done to one branch in some way or other affect the whole. And this stately tree of science—can we content ourselves with merely viewing its external grace and beauty without looking into laws that underlie them, and occasion their very formation?

No enemy to progress is more sure of its end than an ignorant employment of new discoveries. Coincidence of cases may occur, where such discoveries would at once apply. The chances are, however, that such coincidences will not occur, and hence failures attend the attempt to employ them, and prejudices are excited that throw the world back into the errors of the past, and cause it to embrace them with the most tender and ardent affection. Not unlike is this ignorant use of science to the loaded firearm in the hands of the child. There is much more probability of injury to itself than to any object around. The slumbering gases, confined in the thimble full of powder employed have the power of doing a great work. There is nevertheless needed an intelligent mind to superintend their employment, otherwise their power is likely to be exerted on him who endeavors to use the firearm. Then, we appreciate the logic which satisfies the child, that after all, a gun is no very great instrument and that it stands in small comparison along side of the bow and arrow, or even stones for destructive purposes, with which latter instruments by the way, he is perfectly acquainted. Does not the old adage run thus, "*a burnt child dreads the fire?*" He has performed the experiment, and feels bound to act in accordance with the law, *exuno disce omnes*. If experience teaches, surely he has learned something. Learned what? Learned that gunpowder is useless and at the same time dangerous to him who employs it? Learned that bows and arrows are more available than fire-arms? No! if that were all, he would have conned his lesson very imperfectly.

The true deduction from his own case would be, that his ignorance of the properties of gunpowder was so great, that he is not fit to employ it until this has been removed. But the child unfor-

tunately does not reason thus. He either avoids fire-arms from unpleasant associations, or uses them in a most indiscriminate way. And thus is it with the ignorant physician, who seizes a new discovery in his profession. The first failure causes him to reject all innovations with scorn, or he proceeds, in despite of it, and indiscriminately uses the new discovery for all cases that may come under his observation. Thus he either acts from prejudice against progress, or from blind love of innovation, from a foregone conclusion that the sum of human knowledge has been complete for years, or that every vagary of an idle mind is more calculated to suit the wants of his profession than the established facts of ages.

To understand the true province of a science—the peculiar aid it can bring to any pursuit, and the limits of its sphere of usefulness; these are points of knowledge which must be mastered before its facts can be properly applied, which must be laid fully before its students in order to prevent extravagant expectations and unjustifiable pretensions. From a misapprehension of their real nature, all the throes of genius will only result in the production of pitiful abortions, and modern illustrations will abound of the truth of the Horatian line, *parturiunt montes et nascetur ridiculus mus.* The misshapen and deformed monsters which have been thrown over the land by such parturient minds, effect the observer only to disgust or excite the most lively sympathy for the parents' misfortune that has had deformity and ugliness, instead of grace and beauty, as the distinguishing traits of its offspring.

The limits of the sphere of chemistry as applied to medicine have been very little respected by the members of the profession. Even to the enlarged vision of Paracelsus, it was by no means apparent how broad a space was covered. With him it was narrowed down to the mere preparation of drugs and medicines for the healing of diseases. But at the present time the opposite is the prevailing error. Those who have given any attention to the subject are too apt to see *no* horizon properly bounding their range of vision—one wide plain, abundantly fertile in all that can please the senses of man, seems stretching towards the far off infinite, embracing and including everything in the world besides. There is small danger in the present age, of our going back, as a profession, to the narrow and contracted views of Paracelsus. But the danger is great and imminent that, we may fall into the second error and endeavor

to bring all nature, whether inanimate or animate, under the sole control of chemistry. On what point does the danger of the second error rest? An examination of the answer to this question will be really a species of negative reply to the question, "what is the real value of chemistry?"

I would designate as the point of greatest danger to the professional thinking of the present day, a want of reference to the existence of a vital principle permeating every nerve fibre, every muscular fibril, every microscopic cell in the living organism, whether plant or animal, and exerting its mysterious sustaining and controlling power in all these in a way that is beyond the ken of human being, and which was intended to be kept from his knowledge for purposes that are known to the Divine Author, and to him alone. Here is the great error, the hidden rock on which many a beautiful theory has been shivered into a thousand pieces.

An illustration will show the truth of this proposition. When Beaumont found that the gastric juice of St. Martin would digest in a way similar to chlor-hydric acid the food of the stomach, it was not thought sufficient to deduce the proper conclusion from this, that the latter acid constituted a *portion* of this juice. Another conclusion was jumped at, that the gastric juice was *mainly* composed of this acid and that the *whole* process of digestion was a mere *chemical* operation that could be as thoroughly accomplished in the laboratory as in the stomach. Further experiments showed that even the announcement of the composition of the fluid was premature, since this peculiar acid forms but a small portion of the gastric fluid. But the erroneous views into which the profession were led by this chemical theory of digestion were quite numerous, and extended far beyond the theories that were formed as to the causes of the diseases of the digestive organs. What blunders must have been committed by those who groped along in this darkness, we shall leave undisturbed in the records of the past. When the fact, however, was understood that digestion, although partly attributable to chemical actions, yet was a *vital* process holding such actions under a species of control, then, for the first time, was a proper appreciation of its true nature secured and we were prepared to understand what remedies were required in certain pathological conditions.

The great blunder consisted in the nature of the viscus being forgotten, in which the operations in the body take place. It is not an article made out of material different from the fluid it contains as would be the case with the porcelain or glass ware of the laboratory, but composed of the same substances, nay, being the very producer of these, the source of their formation. If there were nothing else than mere chemical action, involved in the process of digestion, what protection would the coats of that organ have against their own destruction,—how could the secreted fluid be so powerful in the way of reducing all food to one homogenous mass, and yet be perfectly innocent of any injury to the walls of the stomach? Chemistry fails to account for this. It is not her duty to account for it. Her work has been carried on under the control of another power which has permitted the chymefaction of varied kinds of food, but by a mysterious endowment of life, has protected even the delicate mucous lining of the stomach from injury. Vitality has employed chemistry to work and assigned her definite limits. When vitality ceases this supervision of the work, then chemistry has no restraining power over her, save her own laws; and mucous and muscular and serous coats are all speedily attacked and alike made to undergo metamorphoses, that ensure the disappearance of complex, highly organized forms, to reappear in those which are simpler. The chemical theory of digestion was fair and specious at first sight, but it could not withstand examination, much less the shock it received from experience. The chemico-vital theory opens another field. Man has learned where his ability to control this process of nature must cease, and hence though the range of his field of study and experiment has been greatly reduced, yet the results, now obtainable, are likely to withstand proper and suitable tests.

It is not the province of chemistry, nor of science in general, to explain absolutely the phenomena of living beings. These may be in part chemical, in part physical, but they are always vital. But a few years have elapsed since the electric theory of life was proposed. The action of nerve force was seen to be instantaneous and to resemble, in many points, the electric fluid. A certain order of mind has the peculiar faculty of leaping from resemblances to positive conclusions as to identity. No space can be too great for it to pass over at one bound, no obstacles too numerous or great to interfere with the rapidity of its movements. To pass from the

fancied resemblance to the positive statement that electricity and nerve force were identical; was but a small task for such a mind. And now began a series of ideas, each more unfounded than its predecessor—at first merely whimsical and chimera-like, then more and more outré, until finally the baldest materialism intruded itself and the theory became monstrous. For it seemed as if the application of the idea of electrical causes for minor phenomena could not be sufficiently comprehensive to satisfy these sciolists, and therefore to make it larger and more comprehensive, life itself was declared to be but a phase of electricity. Then the step was a small one to the silly conclusions of Crosse and Weeks, who claimed to have originated living beings by the mere action of electricity on inorganic matter. The theory had been carried out to its fullest extent. All its gross and impious deformities exhibited themselves in the shape of an infidel materialism, too repugnant for any one to tolerate, unless all the sacred recollections and associations of his youth were to be banished from memory. The necessary reaction from all this would have been a denial of the agency of electricity in any of the vital phenomena, had not prudent and careful men been experimenting on its probable presence in the system and the laws which governed it there, together with the action of vitality on it. We have now a young science, vital electricity, which serves to aid in clearing up many an obscure point in a diagnosis and in aiding in the treatment of disease.

The misuse of chemistry in the profession, appears however in more cases than we have time to glance at here. Its employers have always met failures in their practical applications of the theories which would grow out of such misuse. They have been forced to see, that as the eras of *Solidism* and *Fluidism* had lived their day and been finally forced to die from marasmus, so would all their theories fail to inaugurate an era that should exist any longer than the time required to show their fallacies, and to make way for the appearance of something more durable because more true. The true theory of animal action consists in adopting none of the defunct theories of the past absolutely, but in admitting the presence of a vital action which holds the physical, chemical, and electric actions under a proper rule, causing them all to work unitedly for the good and well being of the organism. The stomach is not a laboratory, but chemical operations are carried on in it with a peculiar kind of

restraint attached to them which invests them with a special character. And the same holds with reference to all other chemical actions in the organism.

The true value of chemistry to the medical profession might be deduced from what has been said of its misuse, and of the errors which have arisen from a false conception of the character of all the actions of vitality, but it seems proper to dwell more specially, on this subject.

What it has done in the past would exhibit a value and importance, that cannot be gainsayed. The benfits which have accumulated from its aid are so intermixed with the present knowledge of the profession—so combined with other subjects of our study, that by simply separating and eliminating them, a striking exhibit could be made of its real value. I prefer, however, to say a few words with reference to its value to the future of the medical profession. There never has been a time in the history of the latter, when its importance and dignity was so fully established, when the storms that had lowered o'er its head were so thoroughly and completely dispersed. It has lived down all aspersions that the malice or envy of the wicked have thrown against its fair fame, and with ever increasing strength and beauty has become more and more worthy of the admiration of the world. Its foundations have become deeply rooted in the earth, and with a stability that must encourage all its sons, it claims one of the highest places among the callings of men. The lines of one of its gifted sons, the genial Holmes, describe in the most striking manner how:

"Its hoary forehead rears
The towering pride of twice a thousand years!
Far, far below the vast incumbent pile
Sleeps the gray rock from art's Aegean isle:
Its massive courses, circling as they rise,
Swell from the waves, to mingle with the skies;
There every quarry lends its marble spoil,
And clustering ages blend their common toil;
The Greek, the Roman, reared its ancient walls,
The silent Arab arched its mystic halls;
In that fair niche, by countless billows laved,
Trace the deep lines that Sydenham engraved;
On yon broad front that breasts the changing swell,—
Mark where the ponderous sledge of Hunter fell,
By that sharp buttress look where Louis stands,
The stone yet warm from his uplifted hands;
And say, O! science, shall thy life-blood freeze
When fluttering folly flaps on walls like these."

The value of chemistry to the physician may be considered as three fold, viz: in its applications to physiology and pathology, to materia medica and pharmacy, and to hygiene. A few words on each of these applications may be permitted me, in order to show that chemistry has not exhausted all its energy by contributions in the past, but is still rich in ability for new discoveries in the future.

Although I have insisted upon the fact that chemical changes *in the* body cannot be considered as identical with those which take place in the laboratory, on account of the regulating and controlling influence of vitality, yet it is not desirable that the other conclusion should be adopted that there are no such chemical changes, and that they cannot be considered as taking place in accordance with definite and fixed laws. All the tissues are composed of definite proximate elements and these again of ultimate elements grouped together in a highly complicated manner. Their normal constitution being thus fixed, when disease invades the system, its effects must often be evinced in some change of tissues or of secretions poured forth from them. In proportion as we understand their normal composition will we be enabled to appreciate any changes that have been produced in it. The department of pathological chemistry cannot be understood unless physiological chemistry has preceded it, and both are as yet, in their infancy. We have before us as questions, the nature of the normal structure, and the cause of those peculiar changes which occur in it: how comes it that vitality which has controlled the chemical actions so far, has permitted them now either to escape from its control or perchance to take on peculiar processes not recognized before;—how happens it that a peculiar waste of the body attends the appearance of a certain substance in the urine? These and a thousand other questions are within the range of chemical research, and can be investigated fairly without any danger of the mind running into materialism. They invite study and hold out honorable rewards to any one that will diligently labor in this field.

Again; the mysterious operations of the nervous system have been up to this time but slightly examined. The wonderful character of this peculiarity of the animal kingdom alone, with the inconceivable rapidity that impressions from the world without are transmitted to its grand centres, and *how instantaneously* the will is supported in all its determinations by the muscular system, this also

opens a field for examination as to its composition and nature, in a fuller and more through manner than has yet been done. There must be chemical changes in every sensation that is transmitted over the nerves, since no effect in nature is produced without a destruction of some portion of the material which has been employed in its production. For every effect in animal life there must be a contemporaneous destruction of some portion of the economy, and hence we must apply this general law to the actions of the nervous system as well as those of the other systems which are found in the animal economy. I feel that nothing more forcibly can be said on this subject than has been expressed by Lehman* in these words: "we may rest assured that the nervous system is not exempt from chemical action; and if the nervous system itself must fall within the domain of chemical contemplation, and a chemical expression remains to be found for its action, no less than for that of digestion and for the formation of the blood, it is scarcely necessary to offer further proof of the fact that chemistry is destined to play the most important part in physiology and medicine." Nothing can be more true also, than the idea of this same author, that chemistry as viewed in connection with the phenomena of healthy or diseased beings, is but one and the same in its laws, and hence that whatever is true with reference to the importance of chemistry to physiology is also true when pathology is under examination. Where it does not now afford an explanation, we have the right to conclude it will in the future, if the discoveries of the past are to be taken as any indication of the charactor of the science. The value then of a science, which is so linked with physiology and pathology, in investigating the various phases of vital action, cannot be estimated by past results or present acquisitions, but must be judged by the boundless field of usefulness which is opened before it in the future. We are but on the confines of discovery. If we shall ever comprehend the true nature of the chemical phenomena of life, we shall be enabled to understand the nature of the control the vital force exercises over it, even though we do not obtain the power to alter this in the condition of disease and restore it to its healthy state.

In the wide field of materia medica and pharmacy the value of chemistry in the future, claims especial attention. Our own Flora abounds with medicinal plants which are by no means inferior to those of other lands, and the mineral kingdom is ever furnishing

*Phys. Chemistry, I. 18.

new compounds with valuable properties. To obtain a proper knowledge of these, and "of all the medicines which the Lord hath created out of the earth," so as to free them from the inert substances with which they are combined is only accomplished by the nicety of chemical manipulation. The complication of formulæ by the mixture of a large number of articles, which excite chemical decompositions and the formation of insoluble and useless compounds must be swept away from the profession. That improvement is needed here, cannot for a moment be doubted by any one who has glanced over the prescriptions put up in a single day, at any apothecary's counter. The most opposite results from those expected are often obtained through changes in the incompatibles which have been thus grouped together. The prevention of such changes can only be effected by an intelligent acquaintance with the chemical properties of these medicinal agents. Every prescription written by a physician with this kind of knowledge will be free from inert substances and will contain in smallest possible space the requisite remedy.

Again; the very selection of remedies must necessarily depend in many cases, upon their peculiar chemical character. The treatment of urinary diseases, we know, depends much on chemistry, at the present time. The deficiences in the urine give true chemical indications of the remedies required. And the microscopist with all the talent and genius he can bring to his work will have accomplished little in the department of urinary deposits, if he is not taught their composition by the chemist. The mere exhibition of forms without a previous knowledge of their composition, is at best, but pastime. The composition being once understood, however, *the forms* serve afterwards to represent it.

Chemistry being the basis of pharmacy, does not ensure more certainty in the elimination of active principles from their vegetable combinations than it ensures enlightened employment of the same with especial reference to changes in the chemical composition of the tissues when the system is laboring under disease.

In hygiene, chemistry has not only taught us the useful properties of pure air and the value of ventilation, but the proper construction of our dwellings so as to combine comfort and convenience, the nature and preparation of the clothing which the varying character of the seasons demands, the nature and effects of the odors

given off by decomposing bodies, the value of disinfecting agents and the best methods of preparing them, the priceless importance of vegetable charcoal as an oxidizing agent and an absorbent of gases;—these have been announced as an earnest of its powers and its resources. The health of large communities has doubtless been much improved, and many a life spared by this kind of information which chemistry has thus laid at the service of public hygiene.

But I feel that before this audience, it would be a work of supererogation to dwell at greater length on these points. They are so plain and transparent that a glance serves to make one fully acquainted with them in all their connections. Permit me however to add, that I can see no reason why the science which thus lends aid to all the departments of medicine should not now be considered, as it *must* be hereafter, the basis of medicine. It was well, years ago when our knowledge of the ultimate constitution of matter was so meagre that the Aristotelean doctrine of four elements was universally accepted, to take anatomy as the base and build up the science of medicine on it as the framework or skeleton. But now, before we can even employ this framework, we find ourselves obliged to ascertain what its composition is, and at the initial point of our study, we must have recourse to the aid of chemistry. If we examine the ovum, the very *punctum saliens* of life is demonstrated to manifest itself in a substance of a complex composition, which is invariably the same. The mystery of life, imparting character and form to matter, thus selects one peculiar organic compound, and only one, in which it shall manifest its vivifying powers. Physiology and chemistry spring conjointly into existence, so far as their connection with the living animal is concerned. The one furnishes the material which being vitalized assumes the forms of organs: and their continuous operations, the other watches until the period arrives when vitality ceases, and the first then claims absolute rule again. Now which of these two sciences, nay, of all the sciences that are required by the medical man, and are within the comprehension of finite minds,—which can be considered as of the first rank in importance—the very basis of all? Am I claiming too much, when I say that the only one that can be considered as meeting at all the idea of a basis for all the others, is chemistry? We claim this without desiring to represent the collateral branches of science as of subordinate importance, or to hold up chemistry as the only ob-

ject of study for the physician. We state our firm conviction, that to it he owes most of that which separates him from the ignorance and superstition of the past—frees him from the charge of empirical practice, gives his treatment of disease a philosophical character that his predecessors with all their longings and strivings were never able to obtain, and elevates him to a position among the benefactors of the human race.

A pertinent question presents itself in this view of the science, which comes home to us all. Why is so little attention paid to the study of chemistry by the very profession which owes so much to its contributions in the past, is benefitted so much by its present aid, and looks forward to the future with hopes based upon its continued revelations? Why does this spirit of inattention date from so early a period in the life of the student, before he has even had a glimpse of what the science includes in its range of study, before his mind has been at all prepared for expressing an opinion on any subject connected with his chosen profession? It will not do to answer this question by the complaint that it is too dry or too tedious, or too abstract. The explanation is *not* to be found in any such qualifying terms. These adjectives have no business relations with the word chemistry. That cannot be dry, or tedious, which opens up so wide a field for investigation of the hidden mysteries of nature,—which shows beauty of design in the composition of the most subordinate parts of the body,—which forms the life of most of the professional investigation and progress of the day. That cannot be dry which is indissolubly connected with every intelligent contemplation of the medical sciences. No! I say this is *not* the explanation. We have often made ourselves believe that such an excuse may justify the carelessness we have shown on this subject, and that our consciences may be invited to take a profound slumber with reference to this carelessness by such an healing balm. But I trust there will be no difficulty in finding that this neglect does not depend upon the intrinsic character of chemistry, but upon two other causes.

First: this carelessness proceeds from a traditional notion, that the science has no reference to the practical wants of the profession,—that it was connected with the other chairs of the medical faculty without a definite idea as to any relation existing between it and them,—that it only consists of physical experiments which have no reference

to organic matter,—and that it speculates now, on mysterious combinations, with the same kind of freedom which it evinced years ago, on the discovery of the philosopher's stone and various other impossible things. These traditions have been handed down from preceptor to student, until they have become fixed apophthegms. The indolence of the student, or his respect for the words of the preceptor prevents him from examining into the subject for himself. The libel on the science is retained. He quietly falls into the beaten track and is numbered, so far as his inattention to chemistry is concerned, in the front rank along with his predecessors. And what becomes of him afterwards, as the years of practice pass quickly by, when his experience should enable him not only to cure disease but to lend an helping hand in its explanation? Is he not recognized as the routine practitioner, solemnly marching along the narrow road that the pioneers of the profession have made for temporary purposes, with military precision and rueful countenance moving forward without a glance to the right or to the left, while on either side countless beauties are to be seen, shorter paths freed from all incumbrances abound, and a brighter sun is shining from behind the clouds? And is not the routine practitioner a near relation of the quack? The one, it is true, boldly throws the flag to the breeze and lets the world know what he is, and what relations he holds to it. But the other borrows the mask of professional honor and dignity, and under it, does not hesitate to follow a fixed routine of treatment—becoming a slave to nosology and all its hideous imperfections. The approximation of the two, in character, is very great. Who will declare, which is the more culpable? The question is one that invites some careful reflection.

This traditional notion of the minor importance of chemistry has actually now produced these results. Let it then be removed and linger no longer on the portals of a physician's office—a black mark indicative of a want within that nothing can fully compensate for.

The second cause for this neglect of the study rests often with those who hold the high and responsible posts of teachers. The student who has been carefully indoctrinated in the principles of his profession by an intelligent preceptor, or who has suspected the fallacious character of the traditional notion of chemistry, resorts to the halls of the medical college, in order to obtain fuller knowledge, and experimental evidence of the truths on which the science

is based. His expectations may be high, and his visions brigh and dazzling. Youth does not readily—especially in this incredulous age—show respect for authority, unless the reasons for that respect be palpable. The science that he has been pleased to believe is living and active, blossoming with the most beautiful marks of its perfection, which the other chairs of the medical faculty continually refer to as the source of much of their own progress and importance, is at last to be presented in very essence and substance to his anxious mind.

Should he meet with one who lives in the elementary experiments of the past, whose recognition of the discoveries of the present has nothing of that glorious enthusiasm about it that invests the labors of the student of science with so much interest, who has failed to catch the living character of the connection between chemistry and medicine, whose dry and lifeless manner extracts the very spirit from his subject and exhibits only a jejune and exsiccated skeleton, how can the natural effect be prevented of a reaction which removes all the student's enthusiasm and excites perfect carelessness or indifference as to the science? Much, very much, depends on this cause, more than on the first impressions of the student imbibed from the contagious effect of bad example. The teachers of our medical schools are invested with enormous influence, that can be wielded as well for the injury of their very specialities, as for their advancement. Happy he, on whose spirit rests the smallest blame for the production of the former; thrice happy he, who contributes most to the latter! The seed implanted in such soil will spring up and bear, thirty, sixty, yea an hundred fold. What the yield shall be, whether of good grain bearing seed in its turn to produce its kind, or of rank and noxious weeds that shall be alike injurious to the profession and the world, it is the bounden duty of the teacher to have a special care for. On this depends the future estimation which the world shall have of his character,—on this, the verdict whether he has been a good and faithful servant, or an enemy in the camp fighting for the downfall and destruction of his own allies.

Gentlemen of the Medical and Chirurgical Faculty of Maryland, shall our own course be marked with a proper appreciation of the value of this interesting and all-important science, or shall we

allow the causes just mentioned to interfere with an investigation of its truths? I know full well, that you are not prepared to admit the latter. The growing interest in the literature of this subject,—a literature which embraces the philosophic German, the sprightly Frenchman, the practical Englishman, and the cool, calculating American among its contributors,—this shows, that there exists throughout our State and in the city where we are now assembled, no small estimate of the subject. The exchange of views that takes place at the meetings of our city and county societies, has been productive of much good in the way of increasing our knowledge of all branches of the profession, and in exciting us to continuous efforts to enlarge our sphere of usefulness. If we act under a conscientious sense of duty, we will zealously endeavor to remove all causes impeding the fullest study of these different branches, and, whether as teachers or as regular practitioners, will work harmoniously together in the good cause. Thus shall we show ourselves worthy members of this venerable association, fit successors to the places which its esteemed founders held among the men of this land,—and inheritors of that spirit of stern and unrelenting opposition to the Protean monster Quackery, under whatever form it may appear, which marked the actions of the incorporators of this Faculty and was impressed upon their charter and constitution. Thus shall we show ourselves worthy of our profession and of an age that is most active in its search for "the right men in the right places."